BA School of Business and Finance
(Riga, Latvia)

KNOWLEDGE MANAGEMENT COMPETENCE FOR ACHIEVING COMPETITIVE ADVANTAGE OF PROFESSIONAL GROWTH AND DEVELOPMENT

Collective monograph

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The collective monograph offers a description of sustainable development in the context of knowledge management as a competitive advantage. The authors of individual chapters chose such a point of view on the topic that they considered the most important and specific for their field of study. Theoretical and applied problems of knowledge management and competitive advantage are investigated in the context of economics, education, culture, politics and law.

CONTENTS

DIGITAL TECHNOLOGIES FOR PROFESSIONAL GROWTH AND INNOVATIVE DEVELOPMENT OF EDUCATIONAL INSTITUTIONS

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ABSTRACT

Academic teaching and learning strategies have been changed recently as a result of expanded access and widespread usage of digital technologies. Innovative digital technologies open various opportunities for all participants in the learning process, avoid stereotypes and enlarge cognitive interest. Awareness of high-tech innovations, their availability and mastery of appropriate methods are the current requirements for teachers of higher education. Our specific focus is on the usage of digital technologies: how they have been applied and how they could be used to improve pedagogical practice at the educational institution and identify their best challenges. Special attention was focused on digital technology usage for academic subjects. The survey was delivered to fourth-year students across Radio Technical Department of Vinnytsia Technical College during 2019-2020 academic year. BYOD technology, Augmented Reality, Net Test have been implemented in the educational process. The results indicate that digital technologies can effectively support teaching and learning processes and provide a better understanding of the academic material for students. As a conclusion, we suggest the majority of students use of digital technologies in their everyday life and as part of their academic study. The learning process is becoming more flexible and provide significant results in the educational process.

Key words: *digital, educational, students, technology, innovative, college, usage, professional growth.*

INTRODUCTION

Academic teaching and learning strategies have been changed recently as a result of expanded access and widespread usage of innovative digital technologies. Increasing of the informatization and knowledge role with wide-spreading of information technology requires a constant search for new ways to improve the educational process and academic disciplines content. Information and communication technologies open various opportunities for all participants in the learning process, avoid stereotypes and enlarge cognitive interest. Awareness of high-tech innovations, their availability and mastery of appropriate methods are the current requirements for teachers of higher education.

The aim of this study was to investigate new innovative digital technologies for improving professional growth and educational activity at the educational institution and identify their best challenges. Special attention was focused on digital technology usage for academic subjects. The survey was delivered to fourth-year students across Radio Technical Department of Vinnytsia Technical College during 2019-2020 academic year.

BYOD technology, Augmented Reality**,** Net Test have been implemented in the educational process of Vinnytsia Technical College and was used to update basic knowledge; to consolidate the studied material; for laboratory and practical training.

Pedagogical collaboration and professional experience sharing of innovative digital technologies usage are based on the studies presented here.

1. BYOD TECHNOLOGY USAGE IN THE EDUCATIONAL PROCESS

Modern Generation Z students openly use mobile phones in their class and no restrictions apply to them. If you can't ban it, you need to use mobile gadgets for learning process benefits. This situation corresponds to *BYOD technology* (Bring-Your-Own-Device), which is implemented in many leading global companies [9, 13]. This means that teachers and students can bring and use their own devices, which allows BYOD technology to be gradually integrated into the learning process. The learning process is becoming more flexible, students are happy to use their smartphones and tablets during classes.

BYOD technology allows speeding up the learning process and redirect students' interest. To keep the attention, the teacher has to think in advance what applications and learning technologies to use. For example, the services such as *Google Classroom, Edmodo, Learn Boost, Coursera, Schoology, Top Hat and Civitas Learning*, *Socrative* [8, 15] allow organizing and controlling the learning process, integrating visual materials to facilitate the topic perception.

Scientists emphasize that the usage of mobile tools in the learning process helps to overcome the communication barrier, form research skills, increase motivation for mastering soft skills, develop critical thinking and use them in real life [17]. In the article we have investigated some modern technologies that allow creating tests and implementing operational control of knowledge using network software for smartphones, tablets and laptops. The Internet Service *Plickers* [6], allows organizing testing with a single smartphone or tablet for a large number of students. QR-codes are used to organize testing in *Plickers* (Fig. 1). Decryption of QR-code information is carried out in the program by the smartphone or tablet camera.

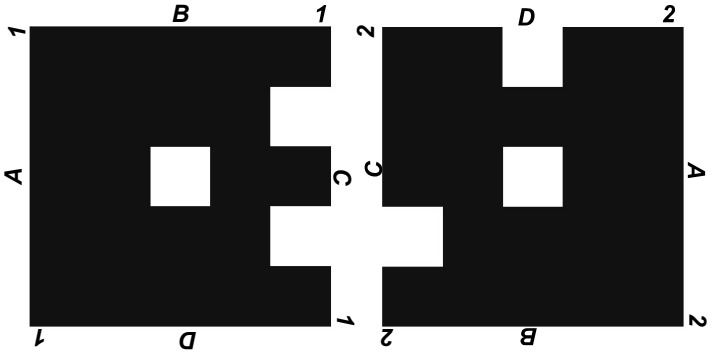

Fig 1. QR-codes in Plickers Service

Source: prepared by the authors

Each student has his own universal card with QR-code (Fig. 2) for all questions. Each card has the number and letters A, B, C, D. The question appears on the screen or in an oral form, students turn the card so that the correct answer is on the top and raise hands so that the teacher can point to the card from his phone with a QR- code the camera and scan the results. The results of students' answers immediately appear on the screen of the teacher's smartphone (Fig. 3) and they are displayed on the big screen and saved for further processing (Fig. 4).

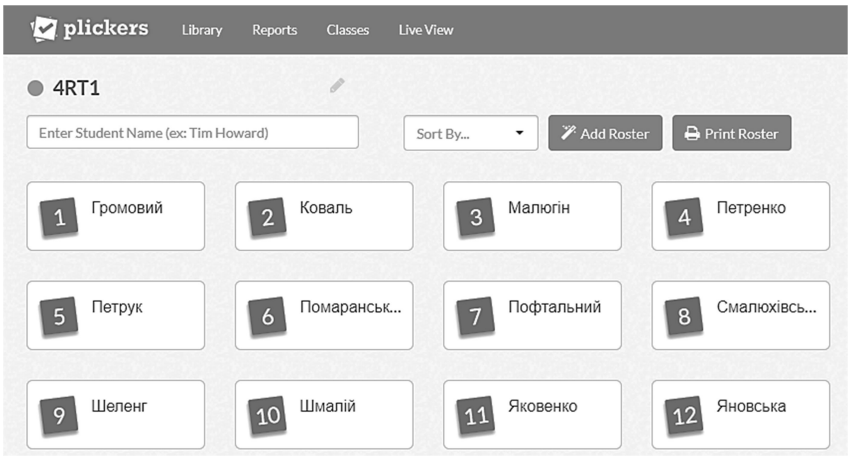

Fig. 2. Students' universal card with QR-code

Source: prepared by the authors

Fig. 3 The results of students' answers

Source: prepared by the authors

The teacher needs to create an account for organizing *Plickers* Internet Service control and install the application on a smartphone or tablet.

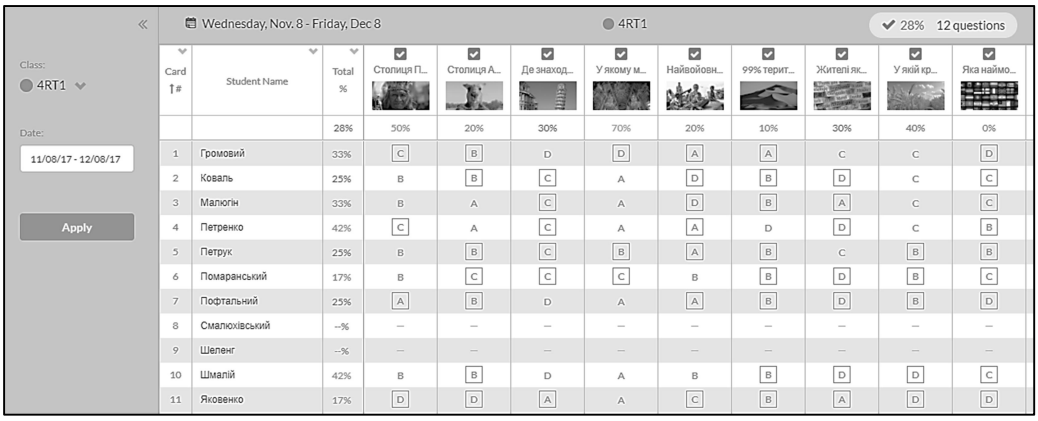

Fig. 4 Students' achievements

Source: prepared by the authors

Free *Kahoot Platform* [5] is designed for learning in a gaming form that is suitable for any discipline. The teacher registers in *Kahoot! Service*, creates either a test (Quiz), or a discussion (Discussion), or a questionnaire (Survey). By selecting the Quiz Mode, the general information about the test is filled in (Fig. 5) and the test questions themselves are compiled (Fig. 6) which can contain pictures, audio, video data.

Fig. 5 Quiz mode in Kahoot Service

Source: prepared by the authors

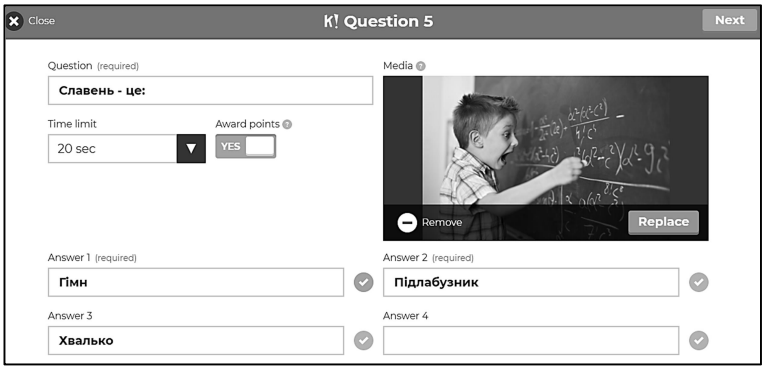

Fig. 6 Quiz Mode (test questions)

Source: prepared by the authors

The testing mode is called *the Play Mode* (Fig. 7). The image from the teacher's computer or laptop is displayed through the projector. A PIN-code (Fig. 1.8) appears in the image to enter the virtual room. Students use a browser or application for smartphones and type a special PIN code. Testing can be organized in the classic way, where everyone is on their own, or you can play as a team (there is an opportunity to discuss a common answer). Questions and answers are displayed on the screen. Each answer is shown in a different color with geometric shapes, which the student has to select quickly on a smartphone or tablet. Students' responses are evaluated by two parameters: correct answers and speed compared to other participants.

Fig. 7 The Play Mode

Source: prepared by the authors

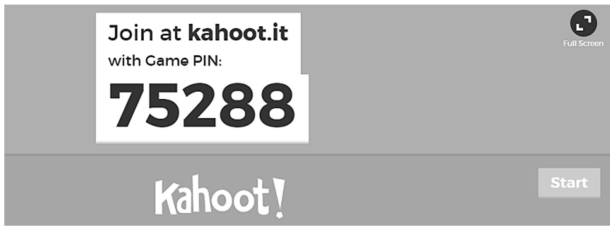

Fig. 8 a PIN-code

Source: prepared by the authors

Fig. 9 QR code

Source: prepared by the authors

The service provides an opportunity to find out how each student responds and results chart of the group is created.

Goggle Forms is one of the common ways to conduct operational knowledge control by the teacher during the lesson [8]. To do this, a test is created on Google Disk, which is sent to students by e-mail or posted on the web resource. The QR code is also can be used (Fig. 1.9). It is printed out and distributed to students or removed from the projector before testing.

Before starting the test, each student fills in a form (Fig. 1.10.1), where he indicates the name, group, e-mail address to which personal results will come. When creating tests in Goggle Forms, it is necessary to configure the mode of mixing answers and questions (Fig. 1.10.2), so that the same questions do not come across students who are nearby.

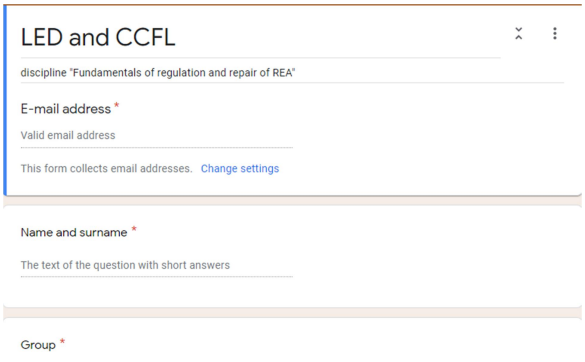

Fig. 10.1 Starting the test in Google Forms
Source: prepared by the authors

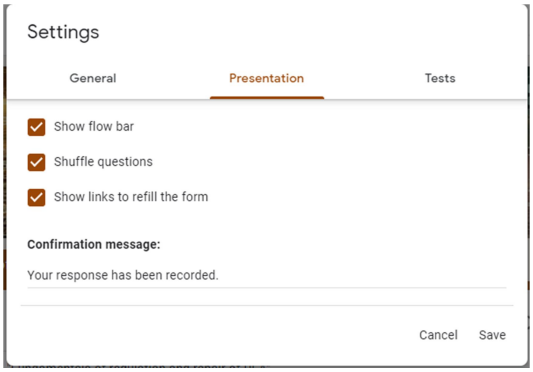

Fig. 10.2 The mode of mixing questions
Source: prepared by the authors

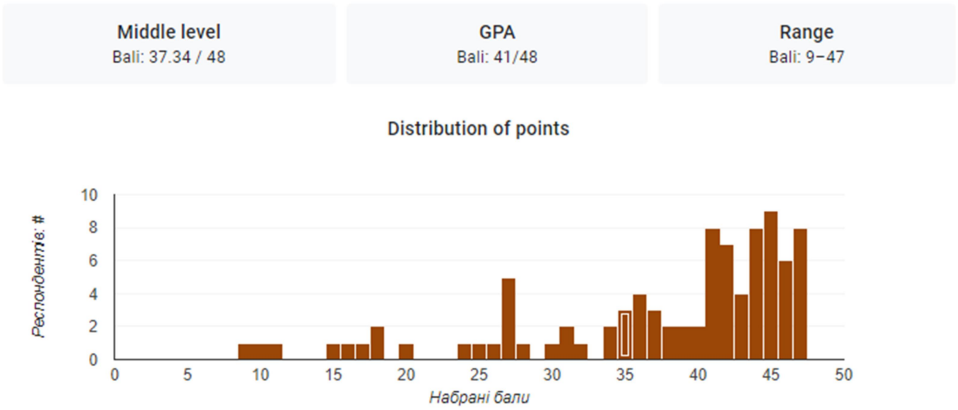

Fig. 11 Test results in Goggle Forms
Source: prepared by the authors

You can view and analyze the test results in Goggle Forms (Fig. 11) or in Google Sheets which are automatically created on Google Disk.

Zeeting is a simple and functional online tool designed to make it easy to manage presentations [18]. Zeeting service provides control over presentations at distance. The Zeeting service is used as an application for a mobile phone or smartphone. During the demonstration, the teacher switches from one slide to another in the personal account from a mobile phone and students who have gained access to the channel watch the presentation demonstration on their phones or tablets in real time. For working with the service, Zeeting account is created, the presentation is downloaded from the computer (Fig. 12).

The Zeeting application on the mobile phone starts the presentation (Fig. 13) and manages it. The computer to which the projector is connected is given the URL of the broadcast channel and the presentation starts automatically. Students also run the URL of the broadcast channel on their phones (Fig. 13).

Slides switching is done on the big screen directly from the web interface on the teacher's phone.

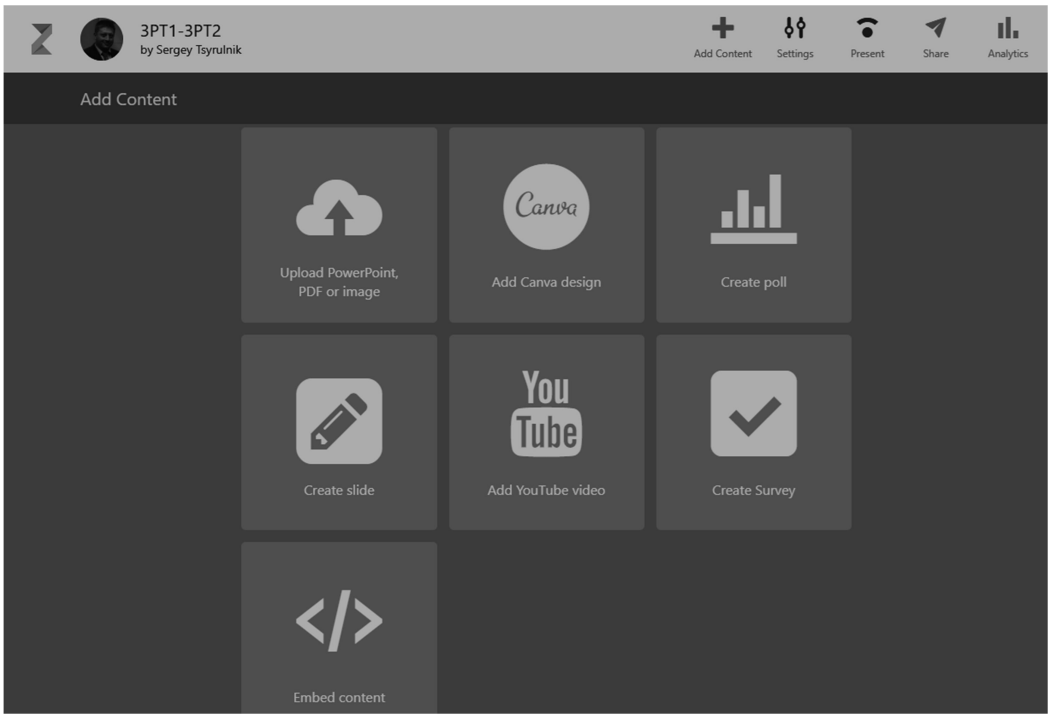

Fig. 12 Zeeting account is created

Source: prepared by the authors

Fig. 1.13 Prezentations in Zeeting

Source: prepared by the authors

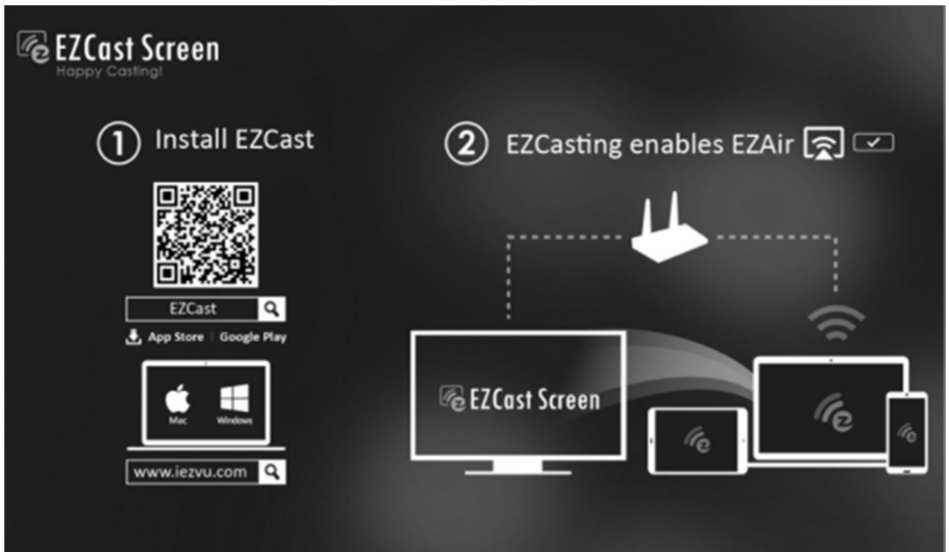

Fig. 14 EZ Cast Technology
Source: prepared by the authors

The usage of *EZ Cast Technology* allows broadcasting images, documents, spreadsheets, presentations, photos, videos from mobile devices on large screens in the Internet absence in the room [4]. EZ Cast technology provides teacher mobility and movement freedom of the educational audience during multimedia content demonstration, solves the problem of convenient presentation management, prevents control loss over student activities (Fig. 14). A modern student must have creative thinking, work in a team, use actively innovative information and communication technologies. The effectiveness of innovative tools, methods, pedagogical technologies depends on students' activity in the process of forming their knowledge, skills and abilities. Therefore, the introduction of BYOD allows speeding up the learning process and making it inquisitive.

2. AUGMENTED REALITY TECHNOLOGIES IN THE PROCESS OF TRAINING SPECIALISTS IN RADIO ELECTRONICS

In the following section we suggest Augmented Reality technologies in the process of training specialists in Radio Electronics. At this stage of our investigation, it is important not only knowledge amount that the applicant receives, but how to use this knowledge in practice, how to implement computer technology in the educational process with communication in classrooms. One of the newest promising technologies that can be used in the educational process is *Augmented Reality Technology* (AR) [2]. For implementing AR it is necessary to master programs or platforms that allow creating your own mobile applications that will be used in the educational process.

This is a fairly new technology that expands the range of available techniques, approaches. Modern technologies are developing, so the education modernization is only a matter of time [11].

Augmented Reality is the complementation of the physical world with real-time digital data. AR uses the environment around us and imposes a certain amount of virtual information on it, such as graphics, sounds and touch response [5].

Mobile applications with AR can significantly increase the interest of modern students in learning disciplines through the usage of advanced multimedia technologies, which allows us to visualize the most complex topics using almost any modern computer, tablet or smartphone.

Among the main advantages of AR in the educational process we suggest the following ones: *visualization* – facilitates memorization process and develops the abstract imagination; *clarity* – a three-dimensional approach allows exploring a device or phenomenon in detail; *curiosity* – real pictures on the pages of the textbook; *modernity* – mastering innovative technologies in the educational process; *portable and available training materials* – with AR you do not need to invest in physical materials and equipment.

AR technology is only taking its first steps in education. One such step is the international project "Augmented Reality in School Environments" (ARiSE), the main purpose of which was to develop an educational platform based on augmented reality technology and test the possibility of its effective application in general education in primary schools [11]. The educational resource on the latest technologies "The Future" [2] provides an opportunity to use educational materials using AR technology in computer science classes.

Based on the practice of using AR-application development (not-gaming/ advertising/medical) tools, but in industrial projects and given the capabilities of AR-platforms to work with 3D-models CAD/CAM/CAE, we can identify the following platforms for developing AR-applications: *D-Fusion* from Total Immersion, *Metaio SDK* from Apple Inc., *Vuforia* from PTC (4).

The analysis of Internet resources showed that there are applications "AR Circuits 4D/Physics" [3, 5] and "Electricity AR" [7] for free usage in electronics and telecommunications.

Wiring diagrams in "AR Circuits 4D/Physics" consist of cards with components of the scheme on which it is necessary to direct the mobile device camera (fig. 15). The program supports the interaction between several cards (markers), thus providing learning in virtual reality.

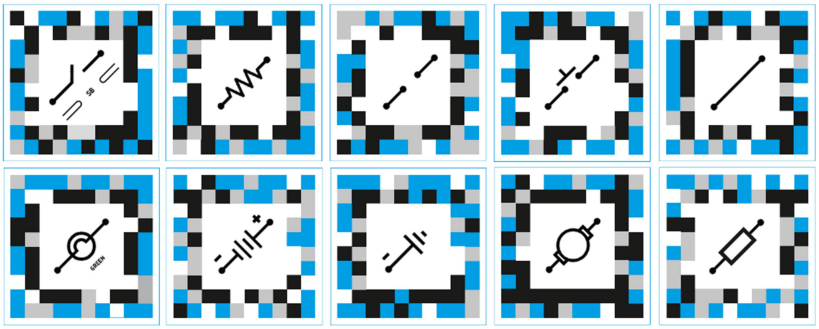

Fig. 15 Wiring diagrams in "AR Circuits 4D/Physics"

Source: prepared by the authors

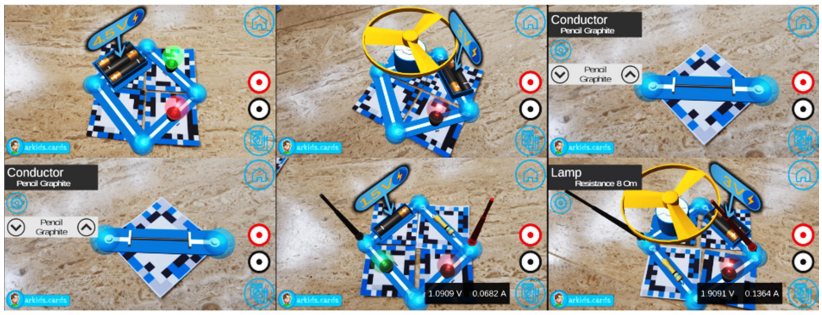

Fig. 16 Sequential, parallel and combined circuits

Source: prepared by the authors

The main components of electrical circuits are a battery, a switch, an incandescent lamp, resistors, an electric motor, a conductor, a ground. These components allow constructing sequential, parallel and combined circuits (Fig. 16). "Electricity AR" will teach to determine analog meters' parameters and make measurements using AR technology [7, 12]. The appendix contains measuring instruments of different design (voltmeters and ammeters) with 9 scales for main parameter determining (Fig. 17); eight 3D models of electric circuits elements with the corresponding symbols.

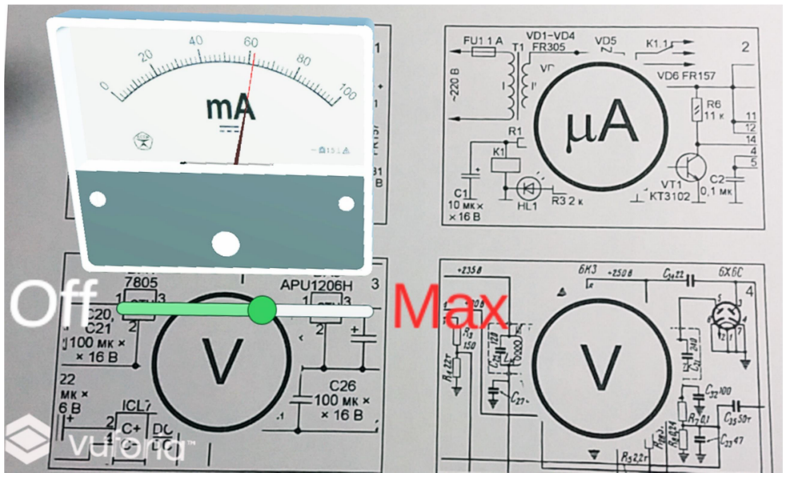

Fig. 17 Main parameter determining

Source: prepared by the authors

The AR Circuits 4D and Electricity AR applications are actually familiar, so the challenge is to learn how to develop your own AR applications that can be used for any academic discipline of higher education in Electronics and Telecommunications branch. This approach will develop students' motivation, as well as increasing of information assimilation level due to the diversity and interactivity of its visual presentation.

According to the latest results AR *Total Immersion, Metaio and Vuforia* occupy more than 80% of the market. *Vuforia* is considered to be the most popular platform.

Vuforia is a platform for creating Augmented Reality applications for phones and tablets on iOS and Android operating systems. The core of the platform is the QCAR library. In addition to the library, the platform includes: Vuforia SDK for developers, Target Manager (system for creating and managing targets), Web services (Vuforia Web Services) for storing targets [2, 10].

A *Target* is any real object, knowing that its application can place virtual objects in the right places. *Image Targets* is a basic type of target, which is a normal picture, such as a diagram, photo or brochure. The image acts as a kind of two-dimensional barcode, only without black and white stripes. It determines which image got into the camera lens, as well as its location in space and scale. Good targets are those that have a lot of contrasting details. The support matrix is built with these parts help for further target recognition.

Simple 3D targets (Cube and Cuboid) are targets in the form of rectangular parallelepipeds (including a cube). For example, such a target may be a package from under the designer, a board game. Like any box, such a target consists of six planes and to create it, you need six pictures for each of them.

Cylinder Targets is a truncated cone with the ability to set the diameters of the bases. In order to create such a target, we need not only to specify the diameters of the bases and height, but also to add three pictures - one for each of the two bases and another for the side surface.

Frame markers are the targets in the form of a specially prepared frame, which is more like a barcode. You can put any picture in this frame. This type of target is used if the image was not sufficiently detailed and it was not possible to create a reasonable image target from it.

Text (word targets). The Vuforia library also has built-in text recognition, so any word or combination of them can be a target. Currently only Latin is supported. This can be used to study foreign technical terms. The targets types of the Vuforia program are shown in Fig. 18.

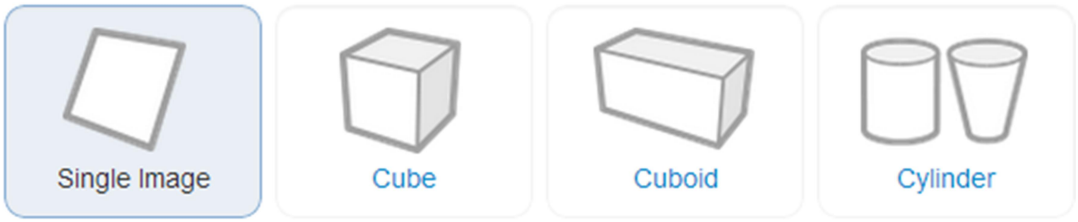

Fig. 18 Vuforia targets types

Source: prepared by the authors

Depending on the targets number required for the application, you can either store them in the so-called Device Database and always have access and recognize them directly on the device, or transfer to Cloud Databases (service from Vuforia Web Services) to store targets and determine them based on data sent from the device. Both approaches have their pros and cons, but deciding on the purpose of the application will not be so difficult to choose. Moreover, targets can be created directly from the application, using the resulting image from the camera.

It is also worth noting that QCAR does not require the entire target to hit the frame. Only a part will be enough to recognize and use it.

With Vuforia, the developer can easily add static and dynamic 3D models (any 3D object or complex animation), virtual buttons, allow interacting with real objects, for example, it can be a button on the target, pressing which launches a simulation of electronic or measuring device, which can be viewed only through the smartphone screen), video and pictures (allow replacing the target or make it more alive), change the background of the picture from the camera (you can not only supplement the picture but also operate with it). To work with models in AR systems "3D-Engine", Unity3D are widely used (computer game development environment Windows, iOS, Android) [3].

The aim of creating augmented reality applications is to create a project and project objects in Vuforia, and the development of 3D scenes for the objects of this project is carried out in Unity 3D. In this case, Vuforia is responsible for identifying the project through the License key and binding to the future scene of the virtual 3D-object (3D-model) will be carried out through the label (Target), which is defined in the Vuforia platform. All operations with Vuforia (with the project, objects) are carried out through the web-interface, that is, Vuforia is a cloud application. And processing with Unity-3D is carried out directly on the developer's computer locally. The connection between the Vuforia cloud project and the local scene processing in the AR application being created should be done by importing the prepared project objects from the Vuforia cloud into the Unity-3D editor environment and complementing the scene with 2D images or 3D models.

We suggest a typical procedure for creating a simple AR application. It is proposed to develop an AR application for Android devices when hovering the device camera on a

real label (image on paper) the user will see a pre-prepared 3D model or 2D-image (operating instructions, explanations, another picture, video, etc.) on the device screen in the playback area.

The application is created by the Unity system, which can be downloaded for free. If you have a 64-bit operating system installed on your computer, it is recommended that you download the latest versions (2018, 2019, ...) that already have the Vuforia augmented reality system integrated. If you have a 32-bit (x86) operating system installed on your computer, you have to install Unity version 5.6 and install the Vuforia package for that system.

We observe main steps:

1. Create or find a 3-D model. The resulting model should be in .fbx format. If the model is created in another format, it must be converted to .fbx one.

Model requirements:

– the number of polygons (triangles): the minimum is possible (for fast processing of the model by a mobile device). If the number of landfills is significantly more than 10 thousand, you should check small curves ("rounded" elements). As a rule, they give the largest number of polygons that do not affect the resulting appearance of the model. If these are found, they should be replaced with elements of the same size, but more "angular".

– the size of textures for small elements (which occupy no more than a quarter of the area on the screen) should be chosen no more than 512 x 512 (for very small you can take 128 x 128 or even 64 x 64). The exception is the same texture is superimposed on several elements of different sizes. Then the best sizes of this texture will be 512 x 512 or 1024 x 1024.

2. Select the image that will be the key (when pointing at the device camera a 3-D model will be displayed).

Image requirements:

– the size of the smaller side must be at least 320 points;

– the image must contain contrasting elements distributed over the entire area. In most cases, we should slightly increase the contrast in the photo editor and possibly make the image sharper (sharper);

– the image has less identical repeating elements;

– the image can be both color and black and white. In any case, the recognition algorithm processes only the black and white image (brightness channel).

3. Register on the Vuforia platform. We create a free developer license for a new product (distribution of applications with such a license is legal only for non-commercial use).

We add key images. After loading each image, the system evaluates it in terms of recognition stability (see image requirements in the previous paragraph) and provides a rating. If the rating is 4-5 stars, the image will be recognized stably. If there are fewer stars, you should consider changing or editing the image. Next, download these images as a Unity package.

4. Launch Unity and create a new project [16]. The standard camera that is present in any new project is removed, instead we add to the project an AR camera from Vuforia (Vuforia – Prefabs – AR Camera). You can place it anywhere. In the camera settings ("Inspector" window) specify the license created on the site (just copy to the appropriate field). We connect to the project a package with key images (Assets – Import package – Custom package). We create a new key image (Vuforia – Prefabs – Image target) and attach one of the prepared images to it. If the key image is not displayed (Image target just looks like a white rectangle), in the Project window in the Editor – Vuforia – Image Target Textures – "Name the key image database created on the Vuforia site section" – only then all key images are seen. For each of the images, select Texture shape – "2D" in the "Inspector" window. We load the prepared 3-D model (Assets – Import new asset), add it to the scene and make it a "descendant" of the corresponding Image Target. It is convenient to check the correct operation of the program in the presence of a Web-camera (just click "Play" and point the Web-camera at the printed key image).

5. The mobile application is created directly in the Unity system. To do this, turn on the Build mode in the Unity 3D editor: File - Build Settings. In this window, select our scene in the Scenes to build section and go to the hardware settings in this operating system – the Player Settings key.

Settings specific to the selected platform (iOS or Android) are made in the section Edit – Project Settings – Player.

After completing all of these settings, you can perform the Build operation by clicking the Build button at the bottom right of the Build Settings window. As a result, we get a request to place *.apk file* of the AR program that is being created on the local machine.

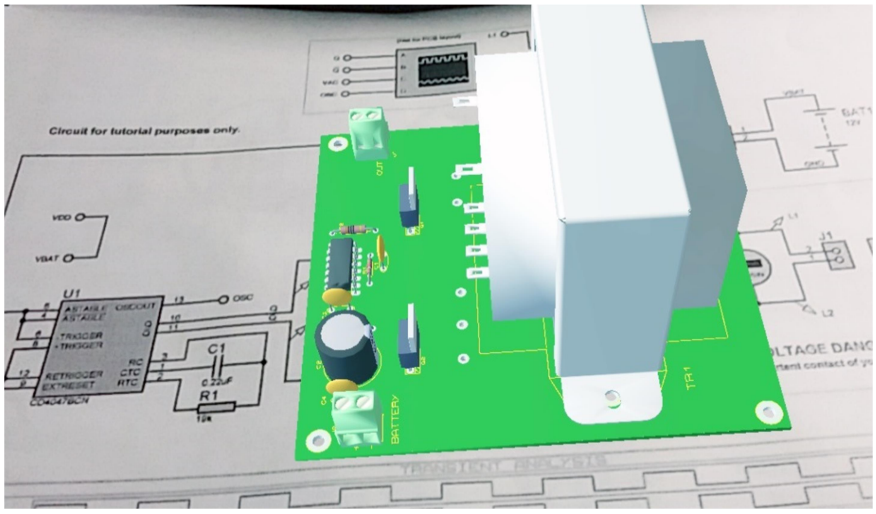

Fig. 19 A mobile application for working with AR objects

Source: prepared by the authors

To compile *.apk file*, firstly you have to install Java DK and Android DK on the local machine (Windows). These are free apps available on developer sites (Oracle and Android). If it has not been done in advance, you will have to perform this procedure during the compilation process, responding to the appropriate system requests.

The .apk file developed by the AR application is stored in the local file system. Now it remains to download it to the Android device in any known way.

The DC-AC converter circuit is used as an example of development. For this purpose, the package of automated design of electronic circuits Proteus Design was used [14]. The package was used to prepare a diagram, a printed circuit board and a 3-D model in *.3ds format*, which was converted to *.fbx format* using Autodesk FBX Converter. Vuforia creates targets (DC-AC converter circuit), Unity3-D creates a 3-D model for targets and creates a mobile application for working with AR objects (Fig. 2.5).

Currently students of Vinnytsia Technical College are working on creating textbooks using augmented reality technology learning "Fundamentals of repairing and regulation of Radio Technical Equipment", "Fundamentals of design and manufacturing technology of Radio Technical Equipment".

Visualization of materials for academic disciplines "Electronics and Telecommunications" will contribute to greater activity and interest of higher education students. Augmented reality opportunities such as dynamic presentation of information, documentary video, interactive stimulators (3D modeling), hyperlinks to clarify information are more attractive to the current generation and should improve the acquisition of professional competencies.

3. CONTROL AND DIAGNOSTIC SYSTEM NET TEST AND FEATURES OF ITS IMPLEMENTATION

Monitoring and assessment of students' knowledge, skills and abilities is an important element of the educational process. Properly organized, it promotes the development of memory, thinking and language of students, systematizes their knowledge, timely exposes the miscalculations of the educational process and serves to prevent them. Basic methods of control of knowledge, skills and abilities as oral examination, written examination, graphic examination, practical examination, test examination are widely used in higher education institutions for the training of technical specialists. So the question is what form of control is most objective for assessing knowledge?

The most effective form of knowledge control today is testing tasks. Test control has a number of advantages. First, it helps to achieve optimal performance of all elements of the learning system by providing feedback aimed at the educational activities of teacher and student. Second, feedback determines the dual nature of control. This is reflected in its implementation in the current (integrated) and final (relatively independent) forms [1].

The problem of monitoring learning outcomes has recently been actively studied by teachers, psychologists, sociologists. However, despite the significant amount of work on learning control, it should be noted that the issue of computerized test control of student achievement is insufficiently studied.

To implement computer testing in educational institutions that do not use the learning management system, use specialized software development. There are a large number of software packages for this purpose, such as Sun Rav, Test Office Pro, Web Quiz, Course Lab, Adobe Captivate, Hot Potatoes, Assistant, Test-W2, My Test, Net Test [4, 19].

The interest in testing is explained by the fact that it significantly increases the efficiency of the educational process, optimally promotes the full independence of each student, is one of the means of individualization in the educational process. The test technique controls the reader's attention and focuses on relevant information, takes little time, minimizes productive difficulties. In addition, the application of tests stimulates the intellectual activity of the student: analysis and synthesis, generalization and specification, comparison and distinction. In addition, test control has many advantages over other types of control.

The main distinguishing feature of the test is objectivity, which is guaranteed by measurement, the function of which is to provide quantitative information about the quality of learning. At the same time, it allows the teacher to check a significant amount of material studied in small portions and diagnose the mastery of this material by most students.

But one of the disadvantages of test control today is that the developed methods are aimed at testing the actual knowledge of students and do not take into account the potential opportunities for personal development, they are only evaluative, not predictive.

Due to test control, you can successfully manage the educational process, improve it, implement a differentiated approach to students.

Test control simplifies the testing of test works, especially when testing is performed on a computer using control and diagnostic systems. In this case, the teacher does not require additional material costs, such as paper, printer ink.

The Net Test [1, 19] software package is designed for mass computer testing of knowledge in a local network running Windows and Linux operating systems. It fully automates: the procedure for selecting questions from the database; time-limited testing on workstations; processing of test results and their design; analysis of results (which issues caused difficulties).

The complex consists of two programs – server and client. The server program allows creating and editing tests, it also provides complete control of computer testing, processing and output. The client program is run from workstations and is designed for student work.

Both programs have a well-thought-out and user-friendly interface, they are built on the principle of "minimum sufficiency" – implement the necessary functions in an optimal way. The student's workplace does not require the installation of any programs, just make a shortcut to the client program hosted on the server.

Each text is a set of questions; the student's task may be as follows:

– choose one correct option;
– note all correct statements;
– enter the answer - an integer;
– enter the answer – a character string (there may be several options for correct answers);
– establish correspondences between pairs of values Fig. 20).

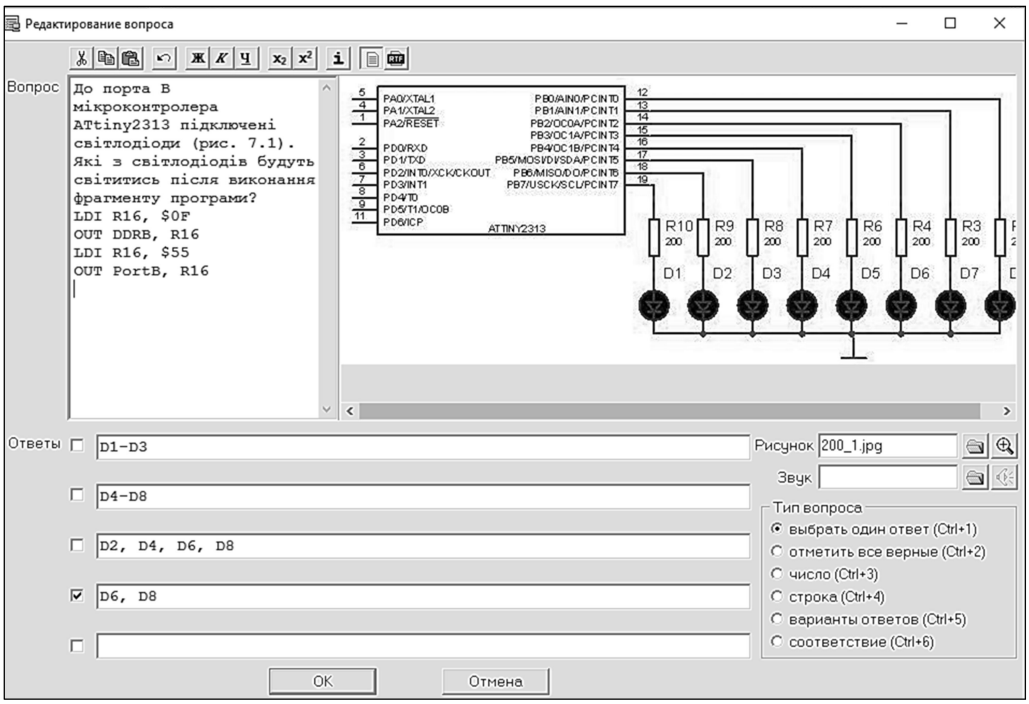

Fig. 20 Correspondences between pairs of values

Source: prepared by the authors

Each question can be associated with an illustration of any size (supported image formats BMP, GIF, JPG, as well as formatted text in RTF format) and / or a sound file in WAV format.

When creating a test, a time limit is set for the entire test. When starting the test, the teacher can change this option. After the specified time, the client program automatically terminates.

The number of questions in each test is not limited. When running the test, the teacher determines how many questions are used in the current test. Questions are selected from the database at random, with all workstations receiving the same set of questions, but in a different order. The program allows controlling the process of passing the test by students through the teacher's computer, set the number of test tasks, time for their passage, the rating scale. The test can contain any combination of any number of one or different modules (multitest (Fig. 21). The sequence of display of questions from the test, the location of the answer options on neighboring computers is different. Thus, each student receives his own, different from the neighbors, a set of questions and answer options.

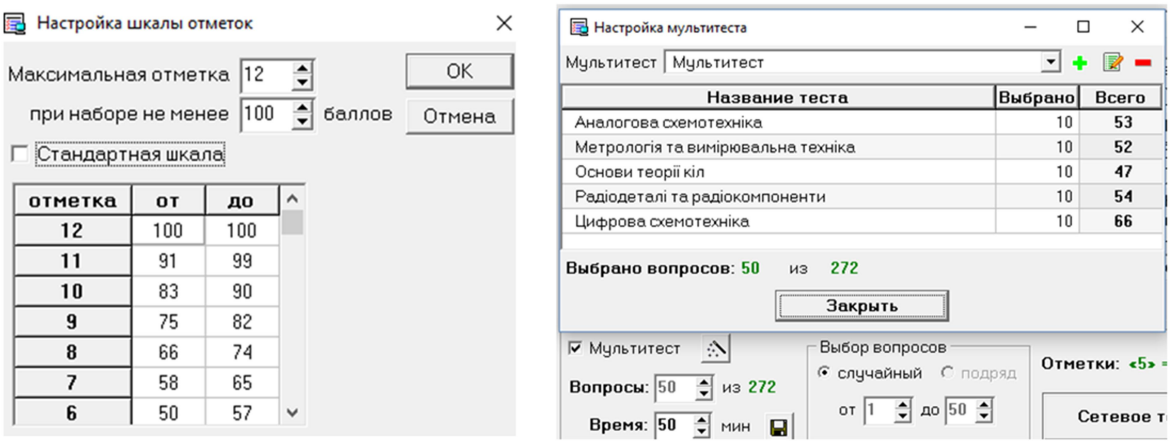

Fig. 21 Different modules of multitest

Source: prepared by the authors

The test file is encrypted and compressed. Finally, with the correct selection of control material, the content of the test can be used not only for control but also for training. To do this, test tasks can be exported to a web page (Fig. 22)

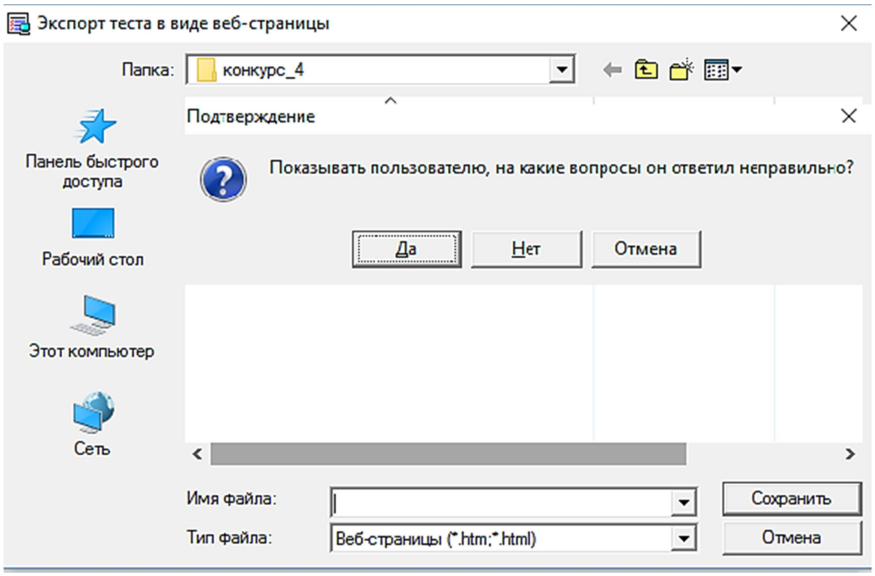

Fig. 22 Test tasks export

Source: prepared by the authors

The usage of test tasks in automated control and training programs allows students to independently find gaps in the structure of their knowledge and take measures to eliminate them. In such cases, we can talk about the significant learning potential of test tasks, the usage of which will be one of the effective areas of practical implementation in the educational process. The disadvantage of Net Test is that it does not allow inserting different characters used in formulas, so all formulas are presented in the form of figures.

The Net Test software package has been implemented into the educational process of Vinnytsia Technical College for Radio Technical Department. The main distinguishing feature of the test is objectivity, which is guaranteed by measurement, the function of which is to provide quantitative information about the quality of learning. The Net Test software package helps to increase the efficiency of studying professional disciplines and allows the teacher to check a significant amount of studied material in small portions and diagnose the mastery of this material by most students.

CONCLUSION

The survey was delivered to fourth-year students across Radio Technical Department of Vinnytsia Technical College during 2019-2020 academic year. BYOD technology, Augmented Reality**,** Net Test have been implemented in the educational process of Vinnytsia Technical College and was used to update basic knowledge; to consolidate the studied material; for laboratory and practical training.

The results indicate that digital technologies can effectively support teaching and learning processes and provide a better understanding of the academic material for students. Innovative methods and technologies provide professional growth, competitive advantage and innovative development of the educational institution. The effectiveness of the latest tools, methods, pedagogical technologies facilitate and accelerate students' knowledge, intensify the process of learning, increase its effectiveness.

As a conclusion, we suggest the majority of students use of digital technologies in their everyday life and as part of their academic study. The learning process is becoming more flexible and provide significant results in the educational process.

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